

**South Carolina Department of Health and Environmental Control  
Bureau of Land and Waste Management**

**Status of the Barnwell Low-Level Radioactive Waste Disposal Facility  
February 2007**

**History**

The Barnwell Low-Level Radioactive Waste Disposal Facility is located approximately five miles northwest of Barnwell, adjacent to the Savannah River Site and South Carolina Advanced Technology Park (formerly the Barnwell Fuel Recycling Plant). The site includes an area of approximately 278 acres. For site operation, 235 acres are deeded to the state and leased to Chem-Nuclear Systems, LLC. The lease, administered by the S. C. Budget and Control Board, expires in 2075.

The facility is one of three licensed commercial disposal facilities operating in the nation. The other facilities are the Hanford, Washington Commercial Facility operated by U.S. Ecology and the *EnergySolutions* site in Clive, Utah. The Barnwell facility has been operated by Chem-Nuclear Systems, LLC since 1971. Chem-Nuclear Systems LLC was purchased by *EnergySolutions*, LLC in 2006.

On June 7, 2000, the Atlantic Interstate Low Level Radioactive Waste Compact Implementation Act was enacted by the S. C. General Assembly. This law superceded all previous legislation applicable to the site. It also established a three state waste compact with Connecticut and New Jersey. South Carolina had previously withdrawn from the Southeast Compact due to the compact's failure to site a new facility in North Carolina. The law authorized a decreasing schedule of annual waste volumes beginning in the 2001 fiscal year. After FY 2008, only waste from the Atlantic Compact states will be allowed for disposal at the Barnwell site. The law also imposed disposal rates to be set by the S. C. Budget and Control Board, operational costs to be reviewed and approved by the Public Service Commission, and a 29 percent profit margin for CNS.

The facility is licensed by the S. C. Department of Health and Environmental Control. The license issued to CNS for the operation of the facility expired July 31, 2000. An application for the license renewal was submitted by CNS April 27, 2000. DHEC held a public hearing on December 11, 2003 to receive comments on the license renewal. Formal written comments were received until January 15, 2004. On March 15, 2004, DHEC staff approved the request for renewal and amended the license for a term of five years. The decision was appealed by the Sierra Club and heard by the S. C. Administrative Law Court in February 2005. The ALC upheld the DHEC staff decision October 13, 2005. The ALC decision is now under appeal by the Sierra Club. Since the license renewal was deemed timely filed, the expired license will remain in effect until a final appeal decision is made.

On November 30, 2005, an amendment to the license was issued requiring CNS to implement additional security controls. On April 20 and May 30, 2006, the transaction on change of

ownership to *EnergySolutions* was approved by DHEC. CNS, a wholly owned subsidiary of *EnergySolutions*, operates the disposal site.

All regulatory activities are funded through fees collected by DHEC. DHEC permits all generators who transport radioactive waste into or within the state and has an effective compliance and enforcement program.

### **Major Changes in Disposal Technology**

In 1995, the S.C. Board of Health and Environmental Control and the S.C. General Assembly approved changes to DHEC Regulation 61-63, Radioactive Material (Title A), affecting the disposal of low-level waste at the Barnwell facility. The changes included requirements for placement of all waste in concrete vaults, cover the trenches with enhanced caps and monitoring system for the disposal trenches. The methods to meet these regulatory changes were developed by CNS and approved by DHEC.

All waste received after December 31, 1995, has been placed in the concrete vaults with the exception of large items that can, by engineering evaluation, be shown to be structurally stable. DHEC reviews these applications on a case-by-case basis. The vaults are placed below the land surface in engineered trenches and the waste is placed in the vaults. The waste is processed to a dry solid and packaged before being shipped for disposal. When filled, the trench is covered with a multi-layer synthetic cover and clay cap to prevent percolation of water through the waste.

The facility design exceeds federal regulatory requirements. Radiological exposures to site workers have been minimal, and there is no evidence that increased exposure to the general public has occurred due to site operations or the transportation of waste.

### **Environmental Monitoring**

The facility is monitored by DHEC and CNS to ensure all state and federal requirements are met. This includes quarterly collection and analyzing over 180 water samples from monitoring wells both on and off site, air samples, soil samples, and vegetation. The only radionuclides detected by the environmental monitoring program are tritium, a radioactive form of hydrogen, and very low concentrations of Carbon 14 and Technetium 99. Exposure to these radionuclides has been negligible because there are no consumers of groundwater or surface water downgradient of the Barnwell facility. The S.C. Budget and Control Board approved expenditures for the placement of multi-layer caps over these trenches to reduce the infiltration of rainwater and migration of all radionuclides. This has been a successful and effective program. In 2003, an Environmental Radiological Performance Verification was completed and reviewed by an independent panel of academic and technical experts to confirm that the Barnwell site will comply with all regulatory requirements for environmental discharges and public protection. The panel concluded that the Barnwell facility poses minimal risk, today, as well as into the long-term future, to either the environment or members of the public.

## **Tax Revenues and Financial Assurances**

Previously, state law imposed a \$235 per cubic foot tax on waste to specifically fund public education. During FY 1995-1999, approximately \$289 million was collected. The Atlantic Compact Act eliminated the per cubic foot tax and provided for extra revenue beyond that approved for disbursement to CNS to be used to fund education. Because of the required decrease in volumes of waste received since 2000, the money provided for education has been reduced.

Since 1971, \$116 million in payments and accrued interests were deposited in the Barnwell Facility's Long-Term Care and Monitoring Fund as required by state law. The Decommissioning and Closure Fund is maintained separately with a balance of \$20 million. The facility operator also maintains over \$200 million in 3<sup>rd</sup> party liability insurance.

## **State Waste Generators**

There are 13 facilities that generate most of South Carolina's radioactive waste. These include four nuclear power plants, five industrial facilities, three research facilities (University of South Carolina, Clemson University and the Medical University of South Carolina) and one being decommissioned (Attachment I). Approximately 24 other facilities such as hospitals and industries generate smaller quantities (less than 75 cubic feet) of waste. However, the majority of the Class A bulk waste generated by the power plants and a nuclear fuel manufacturer is sent to the Envirocare facility in Utah due to lower costs. Table I is a breakdown of the South Carolina waste generator categories compared to the national waste categories for 2006.

## **Low Level Waste Interstate Compacts**

There are now 10 Low Level Radioactive Waste Interstate Compacts established under the federal Low Level Radioactive Waste Policy Amendments Act of 1985. Although attempts have been made, no new regional facilities have opened and most siting activities have stopped with the exception of Texas. If approved, the Texas facility would limit disposal to the Surf and Turf Compact states of Texas, Maine and Vermont with some U.S. Department of Energy waste. The Hanford, Washington, facility operated by US Ecology is available only to the states in the Northwest and Rocky Mountain Compacts. All compacts and unaffiliated states continue to use the Barnwell site, which will only be available through June 2008 and the EnergySolutions Utah facility, which is only allowed to receive Class A waste.

Category	National Cubic Feet	National Percent	South Carolina Cubic Feet	SC Percent
Utility	28,602.98	74.36	2046.70	80.00
Government (Department of Defense)	8,201.97	21.32	116.50	4.55
University	215.14	0.56	7.00	0.27
Hospitals	14.82	0.04	0.00	0.00
Industries	1,430.62	3.72	387.51	15.15
Total	38,465.53	100%	2557.71**	100%

\* Does not account for waste shipped to EnergySolutions, Utah

\*\* For CY2006 South Carolina accounted for 6.6% the national volume disposed at Barnwell.

\*\*\* For the past seven years, South Carolina accounted for 5 to 6% of the national volume disposed at Barnwell.

## Volumes & Capacity

Volumes of waste disposed at the Barnwell facility have decreased steadily over the past seven years. This decrease is due to legislation, the increased use of volume reduction techniques for the large volume waste streams and the disposal of bulk low-activity waste at the EnergySolutions Facility in Utah. This trend is expected to continue. However, the activity or amount of radioactive material in the waste is not expected to decrease and may increase due to the aging of the country's nuclear reactors. With volume reduction, the concentrations of radionuclides in the waste will increase. Table II shows the volumes of waste received since 2000 along with the total activity of the waste. Table III shows the monthly volumes and activities of waste received during 2006, and compare South Carolina to the National Volume disposed at Barnwell. Table IV shows the volumes and activities of waste received since the site began receiving waste in 1971. Attachment II shows the volumes of waste for 2006 received from each compact or state. The total volume of waste disposed through December 2006 is 28.03 million cubic feet. Due to decay, 3.08 million curies remain out of 12.4 million curies received and disposed.

The estimated remaining capacity of the site is 1.2 million cubic feet based on current disposal technology and operations methods. A progressive trench concept submitted by CNS to streamline disposal trench operations would increase remaining waste capacity to approximately 2.2 million cubic feet. After 2008, only 8,000 cubic feet of waste per year is expected to be received from the Atlantic Compact.

Year	National Volume (cubic feet)	South Carolina Volume (cubic feet)	Total Activity (curies)
2000	117,965.54	5,081.97	701,590.37
2001	109,591.83	5,073.30	482,590.37
2002	52,163.23	4,380.04	134,996.88
2003	71,416.22	3,093.35	608,147.43
2004	57,241.56	3,813.21	336,221.29
2005	42,784.98	4,089.44	517,638.39
2006	38,465.53	2,557.72	321,998.01
Total	489,628.89	28,089.03	3,103,182.59

Month	National Volume (cubic feet)	Comparable South Carolina Volume (cu.ft)	Total Activity (curies)
January	1,696.40	120.30	12,848.58
February	2,671.27	327.60	26,127.99
March	2,427.94	20.84	3,439.54
April	2,935.15	120.30	4,724.15
May	3,343.60	8.00	5,036.28
June	11,116.83	225.87	23,941.26
July	2,969.17	367.90	31,418.51
August	1,621.40	137.80	30,488.29
September	2,263.55	385.80	63,207.86
October	2,405.10	358.10	65,587.12
November	2,668.72	250.40	34,571.02
December	2,346.39	234.80	20,607.41
Total	38,465.53	2,557.71	321,998.01

<b>Year</b>	<b>Volume (cubic feet)</b>	<b>Disposed Activity (curies)<sup>1</sup></b>
1971	50,219.34	21,241.20
1972	159,933.47	19,787.39
1973	599,886.28	52,650.97
1974	624,759.55	22,103.10
1975	643,564.44	19,418.68
1976	1,393,587.55	89,911.80
1977	1,636,425.12	395,713.75
1978	2,220,519.72	636,857.82
1979	2,238,322.13	314,938.44
1980	2,444,810.72	143,495.36
1981	1,543,287.67	183,744.31
1982	1,228,200.83	273,961.56
1983	1,240,668.21	383,450.24
1984	1,231,715.28	385,079.07
1985	1,214,422.99	460,600.25
1986	1,053,791.68	116,108.01
1987	958,275.82	211,098.07
1988	931,974.01	219,033.83
1989	1,103,299.56	725,163.57
1990	788,031.90	443,594.19
1991	789,681.85	611,535.76
1992	828,720.34	815,944.28
1993	605,443.07	611,784.73
1994	733,931.04	735,298.41
1995	484,994.32	168,982.13
1996	325,870.60	445,471.36
1997	222,269.48	102,624.48
1998	195,684.084	356,205.46
1999	166,435.11	327,011.64
2000	117,965.54	701,871.12
2001	109,591.83	482,590.37
2002	52,163.23	134,996.88
2003	71,416.22	608,147.43
2004	57,241.56	336,221.29
2005	42,784.98	517,638.39
2006	38,465.53	321,998.01
<b>Total</b>	<b>28,034,299.16</b>	<b>12,395,213.50</b>

<sup>1</sup> Total manifested activity of radionuclides in waste. Due to decay approximately **3.08** million curies remain.

**Attachment I**  
**Major Generators in South Carolina that**  
**Shipped Waste to Barnwell in 2006**

<b><u>Facility</u></b>	<b><u>City</u></b>
Energy <i>Solutions</i> , LLC	Barnwell
Medical University of South Carolina	Charleston
Clemson University	Clemson
Westinghouse Electric Corp. (Nuclear Fuels)	Columbia
UNITECH	Barnwell
University of South Carolina	Columbia
Progress Energy	Hartsville
South Carolina Electric & Gas Co.	Jenkinsville
CVNPA Parr Reactor (Decommissioned)	Jenkinsville
Duke Power (Oconee)	Seneca
NWS Technologies	Spartanburg
Duke Power (Catawba)	York
General Engineering Laboratories	Charleston

**Attachment II  
Compacts and States  
2006 Disposals at Barnwell  
(cubic feet)**

**Appalachian Compact**

Delaware ó 7.50  
Maryland ó 301.32  
Pennsylvania ó 573.42  
West Virginia ó 0.09

**Atlantic Compact**

Connecticut ó 3,422.61  
New Jersey ó 3,785.78  
\*South Carolina - 2,557.72

**Central Compact**

Arkansas ó 195.99  
Kansas ó 140.97  
Louisiana ó 401.50  
Nebraska ó 152.22  
Oklahoma ó 0.00

**Central Midwest Compact**

\*Illinois ó 2,823.79  
Kentucky ó 140.97

**Northwest Compact**

Alaska ó 0.00  
Hawaii ó 7.84  
Idaho ó 0.00  
Montana ó 35.12  
Oregon ó 0.00  
Utah ó 0.00  
\*Washington ó 60.92  
Wyoming ó 0.00

**Midwest Compact**

Indiana ó 0.00  
Iowa ó 178.41  
Minnesota ó 35.12  
Missouri ó 168.99  
Ohio ó 570.42  
Wisconsin ó 114.80

**Rocky Mountain Compact**

Colorado ó 0.00  
Nevada ó 0.00  
New Mexico ó 0.00

**Southeast Compact**

Alabama ó 5,717.23  
Florida ó 292.39  
Georgia ó 737.07  
Mississippi ó 931.67  
Tennessee ó 1,284.42  
Virginia ó 4,925.55

**Southwestern Compact**

Arizona ó 397.76  
\*California ó 1,349.50  
North Dakota ó 0.00  
South Dakota ó 0.00

**Surf and Turf Compact (Texas Compact)**

Maine ó 524.340  
\*Texas ó 279.02  
Vermont ó 464.29

**Unaffiliated States**

District of Columbia ó 12.98  
Massachusetts ó 598.50  
Michigan ó 931.60  
New Hampshire ó 1,389.85  
New York ó 1,366.50  
North Carolina ó 739.57  
Puerto Rico ó 0.00  
Rhode Island ó 0.00

**\* Host States**